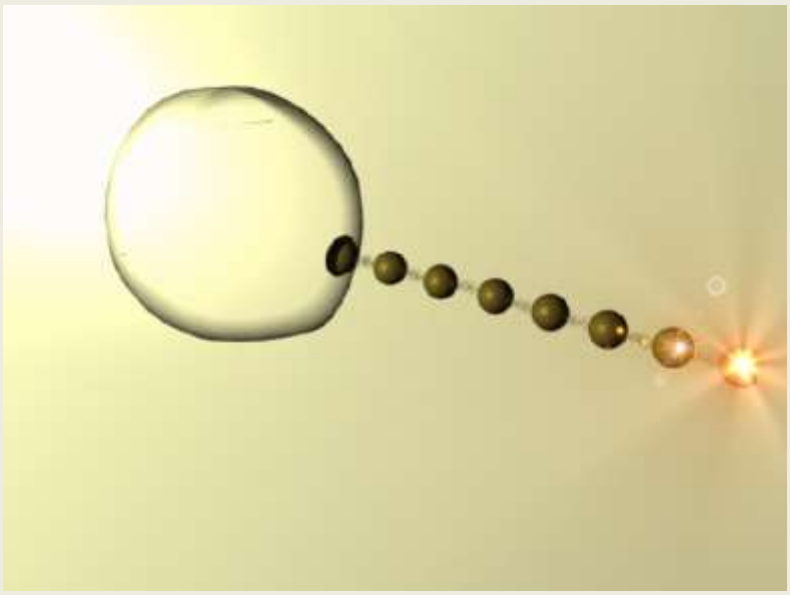
Instituto Universitario de Ciencia de Materiales Nicolás Cabrera

Activity report 2011



The Nicolás Cabrera Institute is named after the founder of the Physics Departments of the UAM. His pursuit of excellence in Science and open approach to industry and the problems of society shape the activities of the Physics Departments of the UAM active in Materials Science.

http://www.uam.es/inc

INSTITUTO NICOLÁS CABRERA

Campus Internacional de excelencia UAM+CSIC

UNIVERSIDAD AUTÓNOMA DE MADRID

FACULTAD DE CIENCIAS

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Cover picture: Plasmonic Nanoparticle Chain in a Light Field: A Resonant Optical Sail, S. Albaladejo et al., NanoLetters 11, 4597 (2011).

CONTENTS

Welcome

In this document, we present the activities of the Nicolás Cabrera Institute (INC) during 2011. With the election of the present board of the Institute in December 2011, we have started a new period. Our objective is to create an efficient support structure for frontier research, and obtain benefits from active networking among the members of the Institute.

The International Summer Schools "*Frontiers of Science and Technology*", which are organized each year in Miraflores de la Sierra, are the most relevant activity of the Institute. During the Summer School, which has a remarkable impact in the scientific community, internationally recognized scientists meet students from all over the world. In the year 2011 the School was entitled *Surface functionalization of materials for added value applications*, and the next two Summer Schools (2012 and 2013) will be about *Nanoparticles for bio-medical imaging* and *Biomolecules and single molecule techniques*.

This year, we will all start lecturing early September 2012, due to the reform of our University teaching system. Thus, the Summer School 2012 will be celebrated from 16 to 20 July 2012. Now (March 2012), all invited speakers have confirmed the participation to the School. We will make sure that the new dates and the excellent frame of the La Cristalera residence give useful and fruitful collaborations among the participants in this event and the members of the INC.

During 2011, we have also organized other activities, such as seminars, the young scientists meeting, and our doctoral training program. Within this last activity, we highlight the innovative Biophysics Master, which gathers students who find in the Institute a place to start their career in an emerging field. We also continued with the specialized technical course on vacuum technologies, held by our late friend Juan José Hinarejos. The success of this initiative leads the present board to continue and extend such courses in future.

We wish you an enjoyable reading of these pages, and thank you very much for your interest in the Nicolás Cabrera Institute.

Hermann Suderow

Director of the INC

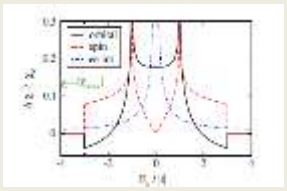
Science at the INC

The members of the Institute have published, during 2011, numerous papers in recognized journals and obtained a significant amount of funding from external competitive calls. The amount of citations to papers where the INC is identified is large, over 1200 each year, and the corresponding h index is of 41. In the following we highlight some publications which we have found particularly remarkable, for different reasons.

Measurable Lattice Effects on the Charge and Magnetic Response in Graphene, G. Gómez-Santos and T. Stauber, PRL 106, 045504 (2011).

The simplest tight-binding model is used to study lattice effects on two properties of doped graphene: (i) magnetic orbital susceptibility and (ii) regular Friedel oscillations, both suppressed in the usual Dirac cone approximation.

Physical Review Letters
moving physics forward



Direct Observation of Stress Accumulation and Relaxation in Small Bundles of Superconducting Vortices in Tungsten Thin Films, I. Guillamón et al., PRL 106, 045504 (2011).

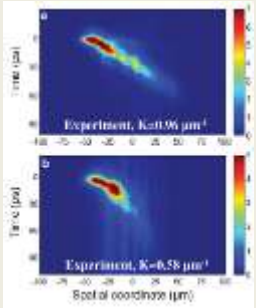
We study the behavior of bundles of superconducting vortices when increasing the magnetic field using scanning tunneling microscopy and spectroscopy at 100 mK.

Physical Review Letters
moving physics forward

Motion of Spin Polariton Bullets in Semiconductor Microcavities, C. Adrados et al., Phys. Rev. Lett. 107, 146402 (2011).

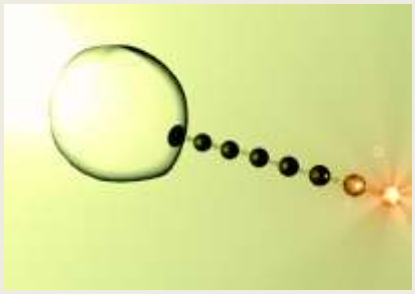
The dynamics of optical switching in semiconductor microcavities in the strong coupling regime is studied by using time- and spatially resolved spectroscopy.

Physical Review Letters
moving physics forward



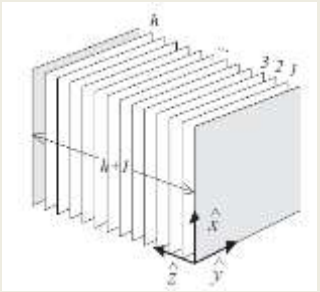
Plasmonic Nanoparticle Chain in a Light Field: A Resonant Optical Sail, S. Albaladejo et al., NanoLetters 11, 4597 (2011).

Optical trapping and driving of small objects has become a topic of increasing interest in multidisciplinary sciences. We propose to use a chain made of metallic nanoparticles as a resonant light sail, attached by one end point to a transparent object and propelling it by the use of electromagnetic radiation.



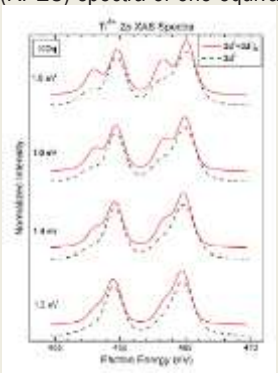
Theory and simulation of the confined Lebwohl-Lasher model, R.G. Marguta et al., Phys. Rev. E 83, 041701 (2011).

We discuss the Lebwohl-Lasher model of nematic liquid crystals in a confined geometry, using Monte Carlo simulation and mean-field theory.



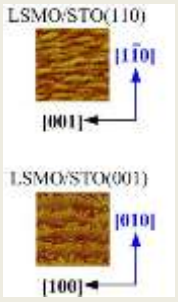
Interface effects in the electronic structure of TiO2 deposited on MgO, Al2O3 and SiO2 substrates, L. Soriano et al., Surface. Science 605, 539 (2011).

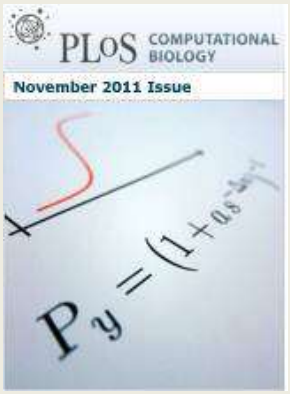
We report the Ti 2p X-ray absorption (XAS) and resonant photoemission (RPES) spectra of one equivalent TiO2 monolayer grown on MgO, Al2O3 and SiO2 substrates.



Tailoring magnetic anisotropy in epitaxial half metallic La0.7Sr0.3MnO3 thin films, P. Perona et al., J. of Appl. Phys. 110, 013919 (2011).

We present a detailed study on the magnetic properties, including anisotropy, reversal fields, and magnetization reversal processes, of well characterized half-metallic epitaxial La0.7Sr0.3MnO3 (LSMO) thin films grown onto SrTiO3 (STO) substrates with three different surface orientations, i.e., (001), (110), and (18).



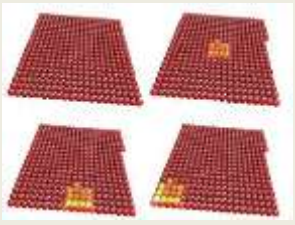


Collective Animal Behavior from Bayesian Estimation and Probability Matching, A. Perez-Escudero et al., PLoS Computational Biology (2011).

Animals living in groups make movement decisions that depend, among other factors, on social interactions with other group members. Our present understanding of social rules in animal collectives is mainly based on empirical fits to observations, with less emphasis in obtaining first-principles approaches that allow their derivation. Here we show that patterns of collective decisions can be derived from the basic ability of animals to make probabilistic estimations in the presence of uncertainty.

Second-layer nucleation in coherent Stranski-Krastanov growth of quantum dots, J.E. Prieto et al., Phys. Rev. B 84, 195417 (2011).

We have studied the monolayer-bilayer transformation in the case of the coherent Stranski-Krastanov growth. We have found that the energy of formation of a second-layer nucleus is largest at the center of the first-layer island and smallest on its corners.



Most of the INC members belong to one of the Physics Departments of the UAM active in Materials Science:

Departamento de Física de la Materia Condensada, directed by Enrique García Michel. http://www.uam.es/departamentos/ciencias/fismateriac/

Condensed Matter Physics provides the methods to engineer and develop new ideas in different key technologies. Using advanced instrumentation, such as microscopy, spectroscopy, and calculation techniques, the members of the Department control and directly observe phenomena belonging to the challenges of technical development. For example, the development of new electronics and spintronics, the use of nanostructures in applications, or improvements in energy storage. Members also address fundamental questions in subjects such as graphene, superconductivity, or the properties of single molecules arising at extreme conditions, ranging from ultra-high vacuum to ambient pressure and from room to very low temperatures.

Departamento de Física Teórica de la Materia Condensada, directed by Rosa Monreal.

http://www.uam.es/departamentos/ciencias/fisicateoricamateria/propia/default.html

The Department is involved with the physics of condensed matter from a theoretical point of view. What is condensed matter? It includes liquids and solids, i.e. phases dense enough so that the interactions between the atoms or molecules making up the phase are relevant (by contrast, interactions in gases do not usually play any important role). Depending upon the system the Department members apply different theoretical approaches based on quantum mechanics and/or statistical physics. Very often computer simulation techniques are necessary.

Departamento de Física Aplicada, directed by Carmen Morant.

http://www.uam.es/departamentos/ciencias/fisapli/

From its beginnings, the Department of Applied Physics has kept a clear research orientation towards possible applications in industry. In that sense, early research was conducted in such as microelectronics, materials for solar energy conversion, advanced materials for optoelectronics, etc.. Nowadays, these areas have evolved into nanomaterials and nanodevices, but always keeping the applied orientation. Thus, research conducted in the Department of Applied Physics falls within the field of Science and Engineering of Advanced Materials. Particularly, the Department has a strong research tradition in Surface Physics, Surface Functionalisation, Thin Films, Hard Coatings, Materials for Optoelectronics, Nanostructured Materials, Space Materials, Photovoltaic Materials, Magnetic Materials, Biomaterials and Polymers.

Departamento de Física de Materiales, directed by Ginés Lifante.

http://www.uam.es/departamentos/ciencias/fisicamateriales/

Research activities deal with the study of optical and electronic properties of a wide range of materials, mainly dielectric and semiconductors. Present research lines include: crystal growth, ferroelectric materials and phase transitions, materials for the solar-hydrogen system, electron paramagnetic resonance spectroscopy, semiconductor nanostructures spectroscopy, ultrafast spectroscopy in semiconductor nanostructures, solid state lasers, optical waveguides and non-linear optics, advanced materials for integrated photonics, sensors and bio-markers, and multifunctional nanoparticles.

Nicolás Cabrera Summer School

The Nicolás Cabrera Summer School is organized yearly since 1994, and benefits from the full support of the program "Frontiers of Science and Technology" of the Fundación BBVA.

Fundación BBVA

The web of the INC has all information about previous Summer Schools. During the past five years, the Summer School has had the following titles:

- Self-organization patterns in nature: from molecules to humans (2010).
- Spin transport and dynamics in nanostructures (2009).
- 100 years of liquid helium: new Physics at the edge of absolute zero (2008).
- Nanophotonics and Optics (2007).
- Biophysics of biological circuits: from molecules to networks (2006)

B. Cabrera (Stanford) during the School 2008.

The School 2011 was organized from 11-16 September 2012 by Leonardo Soriano and Alejandro Gutierrez, with the title "Surface functionalization of materials for added value applications" in Miraflores de la Sierra. Its main objective was to show the potential of surface functionalization for designing new high added value materials. The participants reviewed the main surface modification techniques for different applications: mechanics, biomedicine and spintronics. The School worked in particular in understanding the fundamental phenomena which control surface modification and thin films growth, as well as micro and nanosized control of surfaces and thin films, and optimization of growth processes. The important development of new devices and applications in functional materials for different technologies was a further point of interest. The following subjects were presented:

-**Functionalization of hard coatings and wear resistant materials.**

-**Biofunctionalization.**

-**Functionalization of materials for Solar Energy.**

-**Functionalization of Magnetic Materials.**

-**Carbon based functionalization (organic molecules, carbon nanotubes, fullerenes, graphene).**

The school had 21 invited speakers from Spain, France, Great Britain, Germany, Austria, USA and Switzerland:

J.M. Albella (ICMM-CSIC, FUNCOAT, Spain)

A. Anders (LBL, USA)

P. H. Mayrhofer (Montanuniversität Loeben, Austria)

A. Erdemir (Argonne National Laboratory, USA)

J.C. Sánchez López (ICMSE-CSIC-FUNCOAT, Spain)

O. Klein (CEA-Saclay, France)

J. Santamaría (Univ. Complutense de Madrid, Spain)

O. Schmidt (IFW Dresden, Germany)

Laura Lechuga (CIN2-CSIC, Barcelona, Spain)

G. Liu (Univ. California Davis, USA)

Simon Scheuring (Institute Curie, Paris, France)

B.L. Miller (Univ. of Rochester, USA)

P. de Andrés (DIPC, San Sebastián, Spain)

J.M. Triscone (Univ. Geneva, Switzerland)

M. Lira Cantú (ICMB-CSIC-NANOSELECT, Spain)

M. Varela (Oak Ridge Nat. Lab., USA)

F. Gazeau (Université Paris 7, France)

A. Roig (ICMB-CSIC-NANOSELECT, Spain)

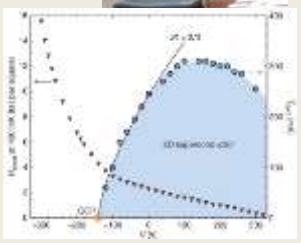
R. Miranda (IMDEA Nanociencia, Spain)

R. Fasel (EMPA Zurich, Switzerland)

R. M. Lambert (U. Cambridge and CSIC)

We highlight

Jean Marc Triscone. Jean Marc is leader of the complex oxides group of the Geneva University. He did his PhD thesis in 1987 with O. Fisher in Geneva and has been visiting professor in Stanford. He has been deputy director of the Swiss excellence center in Materials Science MaNEP, and is, since 2007, Dean of the Faculty of Science of Geneva. He discovered interface superconductivity and new types of ferroelectricity.



All invited speakers have confirmed their participation to the next School 2012. About 20 students from Japan, China, Turkey, Poland and Canada are already registered.

Seminars 2011

During 2011, the following seminars have been organized:

Friday 17 June 2011**, "From ultrastable glasses to antiferromagnetic transitions in thin films: New possibilities using Nanocalorimetry",** Prof. Javier Rodríguez Viejo (Grupo de Nanomateriales y Microsistemas, GNaM, Universidad Autónoma de Barcelona)

Friday 4 March 2011 **"Unraveling molecular interactions by mechanical unzipping: a physicists approach",** Prof. Félix Ritort. (Departament de Fisica Fonamental, Facultat de Fisica, Universitat de Barcelona).

Friday 18 February 2011**"Superinsulation: reverse of the superconductivity. Experiment and theory",** Prof. Tatyana Baturina , A. V. Rzhanov (Institute of Semiconductor Physics, Russia), Prof. Valerii Vinokur (Argonne National Laboratory, USA).

Friday 14 January 2011**, "Directed motion of driven particle systems on periodic substrates: from superconductors to bacteria",** Prof. Charles Reichhardt, Theoretical Division, Los Alamos, USA.

We highlight

Valerii Vinokur. Valerii is researcher at the Argonne National Laboratory.

He received the 2003 John Bardeen's prize "for influential contributions to vortex matter theory", together with A. Larkin and D. Nelson. He is co-author of one paper with more than 3500 citations, and of 30 papers with 100 citations or more. He visited the Condensed Matter Physics Department, together with T. Baturina of Novosibirsk, during one month. He was invited by H. Suderow and S. Vieira in the frame of the program Consolider-Ingenio "Nanociencia Molecular".

Young researchers meeting

The young researchers meeting 2011 was organized by the new board, and more than 40 young students of the INC went to the La Cristalera residence to discuss, in a relaxed atmosphere, about the following subjects :

-*Spatial and temporal coherence of polariton condensates*, Rita Spano (Departamento de Física de Materiales).

-*Anderson-Holstein model: Separation of Timescales*, Klaus Ferdinand Albrecht (Departamento de Física Teórica de la Materia Condensada).

-*Ion beam damage by electronic excitation with swift heavy ions in lithium niobate*, Miguel Crespillo Almenara (Centro de Microanálisis de Materiales).

The meeting at La Cristalera.

Invited speaker
D. Perez De Lara
(IMDEA Nanociencia).

-*Nuevo método de crecimiento de grafeno sobre metales nobles mediante irradiación con etileno*, Antonio J. Martínez Galera (Departamento de Física de la Materia Condensada).

-*High mobility n-type Zn3N2 thin films as channel for thin films transistors*, Carlos García Nuñez, (Departamento de Física Aplicada).

-*VdW-DFT calculations in CH4 and CO2 hydrates*, Guillermo Román (Departamento de Física de la Materia Condensada).

-*Flexibility and robustness in cellular signaling*, Javier Estrada (Grupo de Biofísica, Departamento de Física de la Materia Condensada).

-*Aislantes ópticos de amplia respuesta espectral para aplicaciones en el rango UV-nIR*, Pablo Molina de Pablo (Departamento de Física de Materiales).

D. David Perez de Lara, of IMDEA Nanociencia gave an invited talk about superconducting nanostructures and the possibilities of nanolithography.

All contributions are available at the web of the INC.

Masters, courses and students

During the academic year 2010-2011, the researchers and professors of the INC participated in the 5 Master degrees in Materials Science of our Faculty.

The Biophysics Master was initiated by the INC one decade ago. The Master had 20 students from different disciplines: Biology, Physics, Biochemistry, Informatics, Mathematics and Biotechnology, coming from different Universities (Autónoma and Complutense in Madrid, Politécnica in Madrid, Barcelona, Valladolid, Murcia, Sevilla and Basel).

The Biophysics Master has a strong interdisciplinary character, with 18 teachers of the UAM (from 7 Departments of the Faculty of Science) and 18 associated teachers of different places within Spain and abroad. The Master has Erasmus agreements with Université Paris 7.

We highlight

The following work, which has been made by Physics students.

Calibrating the frequency of tuning forks by means of Lissajous figures, J. Quereda et al., Am. J. of Phys. 79, 517 (2011).

We produce Lissajous figures by modulating a laser beam along two perpendicular directions by means of two tuning forks.

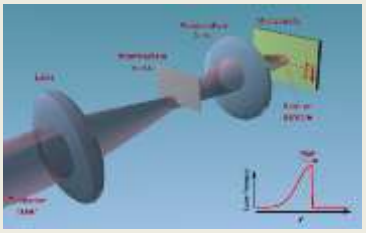
The course "Introduction to physics and technology of vacuum systems" was organized from 9 to 19 May 2011 by Dr. Juan José Hinarejos Murillo. It was a great success, with the participation of 25 students of different origin: 5 from UAM, 9 from CSIC, 4 from CIEMAT, 2 from IMDEA Nanoscience, 2 of Thales and 3 from other institutions.

The next edition of the course, in 2012, will be organized by Amadeo Vázquez, Leonardo Soriano, Jesús García Goñi and Jose Luis Fernández Cuñado. Other technical teaching courses will be offered.

We highlight:

Alberto Amo, alumnus of the Departamento de Física de Materiales, published in June 2011 the paper "Polariton Superfluids Reveal Quantum Hydrodynamic Solitons" in Science.

A. Amo et al., Science 332, 1167 (2011).



Alberto is researcher at the Photonics and Nanostructures Laboratory of the CNRS in Paris.

MASTER IN BIOPHYSICS

http://www.uam.es/biofisica

The Postgraduate Program in Biophysics is fundamentally an introduction to the experimental sciences area research. Its main goal is to teach the physical principles of biological processes and the used techniques and Physical methodologies for its study. Specific objectives are :

- To provide knowledge on Biology and basic Biochemistry or on Physics and Mathematics, necessary to attend the rest of the program. For that reason several updating subjects are offered to students so that they alternatively attend them according to their background (Elements of Physics and Mathematics and Elements of Biochemistry, Molecular Cellular and Genetic Biology).

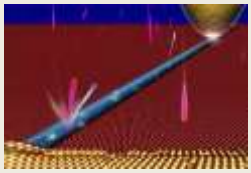
- To provide a general overview of biological processes at different organization levels (molecular, cellular, histological and physiological) emphasizingthe physical principles of the biological functions (Molecular Interactions, Cellular Organization, Development Biology, Systems Organization).

- To provide a basic knowledge of the advanced experimental and computing techniques that provide deeper insight of the biophysics of biological systems (Technical Biophysics, Biocomputing, Noninvasive Methods of Medical Diagnosis).

- To provide a practical knowledge of some of the studied techniques (laboratory guided training).

MASTER IN CONDENSED MATTER PHYSICS AND NANOTECHNOLOGY

http://www.uam.es/fmcyn



The official postgraduate programme in condensed matter physics and nanotechnology is a interuniversity program offered jointly by the Autonomous University of Madrid (coordinating university), the University of Murcia and the University of Oviedo. The goal of this programme is to provide graduate students of Physics or related disciplines top level teaching in topical research areas. The focus is on high quality teaching of fundamentals, methodology and technology by internationally recognized experts in condensed matter physics and nanotechnology, with the aim to understand solids and liquids, as well as modern topics of Nanoscience and Nanotechnology.

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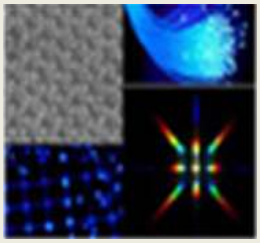
MASTER IN ADVANCED MATERIALS AND NANOTECHNOLOGY

http://www.uam.es/otros/matavnan



The Master in advanced materials and nanotechnologies aims to offer students a unique opportunity to continue with technical and scientific training. Topics are Materials for nanotechnology and modern photonics. Training is focused to start a research career and access professional work market in the area. The master comes from bringing together the previous Advanced Materials and Photonics programs. A large offer of optional courses gives the student freedom to design a personalized postgraduate program.

MASTER IN NANOSCIENCE AND MOLECULAR NANOTECHNOLOGY

http://www.icmol.es/master/nnm

The objective of this Master is to prepare students in the Nanoscience and Nanotechnology fields in order to be able to carry out a professional career in this area or a research activity leading to a doctoral thesis. This Master encompasses several disciplines: chemistry, physics, engineering, materials science, biochemistry, pharmacy and medicine.

The syllabus of the Master is somewhere in between the Nanoscience/Nanotechnology fields and the molecular systems. Therefore, it explores scientific areas of increasing interest such as Molecular Electronics, Molecular Magnetism, Supramolecular Chemistry, Surfaces Chemistry or Molecular Materials Science.

MASTER IN ENERGY AND FUELS FOR THE FUTURE

http://www.uam.es/otros/energía

The Master provides access to doctoral studies and to start professional activity in the area of energy. The master teaches available and future techniques for generation of energy.

The master develops a program in physical and chemical fundamentals, energy and environment, sustainable growth, biomass, thermal conversion of solar radiation, bioclimatic architecture, wind energy, photovoltaic, fotoelechtrochemical and thermoelectric energy conversion, earth bound and space photovoltaic systems, hydrogen, fuel cells, fission and fusion and energy accumulation.

Services for Materials Science

Members of the INC use the common scientific support infrastructure of the Campus UAM+CSIC, which consists of several services and laboratories. In Materials Science, these services have developed numerous activities during 2011. Here we describe this infrastructure, and highlight activities in relationship with the Institute.

SEGAINVEX, directed by Manuel Pazos Abreu.

Highlight: Cryogenics.

The cryogenics service has seen the demand of liquid helium increasing by nearly 70% during past four years. Production has been increased to 40743 liters delivered during 2011. This is a record number in our country, where no other liquid helium provider operates with comparable numbers. Helium consumption is a good indicator of the excellence in the scientific activity in a Campus working in Nanotechnology and Materials Science. The given number is similar to the helium production in Campus of similar size.

The objective of the general experimental research support services (SEGAINVEX), is to give technical support to the experimental activity of the UAM and to promote technology transfer through the development and construction of prototypes and scientific instruments, designed in collaboration with scientists. The SEGAINVEX has played a key role in the development of several spin-off companies of the UAM, some of which have been funded by members of the INC.

The service provides:

- A technical center to design and document projects using modern techniques, to coordinate their construction, and to make the administrative work.
- A mechanical workshop with modern mechanical and welding facilities, and qualified personnel.
- An electronic workshop with modern testing and construction equipment, which has developed many original scientific instruments, including software.
- A glass and quartz workshop.

SIdI, directed by Manuel Hernández Vélez

The SIdI is structured in several units which gather laboratories with original techniques and equipment for materials characterization. The laboratories have highly qualified technical personnel capable to offer a quality service to users. Main objectives of the SIdI are:

- Highly qualified support to research projects through multidisciplinary analysis and characterization of materials and products.
- Implementation of new techniques and continuous development of methodologies to characterize materials and products.
- Scientific, technical and instrumental advice to research groups of the Campus UAM+CSIC, as well as to other public and private organizations.

Highlight:

Members of the INC use numerous laboratorios of the SIdI in their research. Among others, we may cite here TXRF lab (left panel) or nanolithography facility (right panel, showing dots made in graphite).

CMAM, directed by Alessandro Zucchiatti

Highlight: Collaboration with museum.

CMAM collaborates in a project together with the CSIC and the Museo de América of Madrid to study new techniques in non desctructive analysis and observation of metal museum pieces.

The Centre for Micro Analysis of Materials (CMAM) is a research center belonging to the Universidad Autónoma de Madrid (UAM) whose main experimental tool is an electrostatic ion accelerator with a maximum terminal voltage of 5 MV, devoted to the analysis and modification of materials. CMAM is the result of a project financed though the FEDER program and developed under the guidance of the Instituto de Ciencia de Materiales Nicolás Cabrera (INC) between 1998 and 2001.

The experimental equipment consists of the accelerator, its beam lines, dedicated to various application areas and several ancillary equipments (micro-analytical techniques, sample preparation). The accelerator, built by HVEE, can deliver practically any element of the periodic table from a solid target.

Nanofabrication center CEI UAM+CSIC

During 2011, work to build a new nanofabrication center has been pursued, under the supervision of Daniel Granados. Daniel belongs to the IMDEA Nanoscience Institute, headed by Rodolfo Miranda. The new center will be used to fabricate nanostructures using different kinds of lithographies, from “soft lithography” to electron and ion beam lithography.

The center will give the members of the INC and other users of the Campus the possibility to use highly competitive nanofabrication techniques. The center will be located in the clean room of IMDEA Nanoscience.

Highlight:

The nanofabrication center will provide users with latest equipment, chosen taking into account the needs of the Campus. All equipment will be available in a single location. Among available equipment, we highlight the crossed ion and electron beam system, with injection of up to seven precursor gas molecules. This will allow deposition of metals or selective etching, with nanometric positioning.

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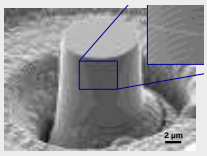

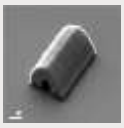

Some publications

J.E. Prieto, I. Markov: *Second-layer nucleation in coherent Stranski-Krastanov growth of quantum dots;* Phys. Rev B **84**,195417 (2011)

S. Albaladejo, J.J. Saenz, M. Marqués: *Plasmonic Nanoparticle Chain in a Light Field: A Resonant Optical Sail;* Nano Letters **11**, 4597-4600 (2011).

P. Prieto, K.R. Pirota, A. Climent-Font, et al.: *Magnetic antidot arrays on alumina nanoporous membranes: Rutherford backscattering and magnetic characterization*; Surface And Interface Analysis, B: **43**, 1417-1422, (2011).

G. Gomez-Santos, T. Stauber: *Fluorescence quenching in graphene: A fundamental ruler and evidence for transverse plasmons;* Phys. Rev. B **84**,165438 (2011)

I. Guillamon, H. Suderow, J.G. Rodrigo et al.:.*Chiral charge order in the superconductor 2H-TaS(2);* New Journal Of Physics **13**, 103020 (2011).

P. Perna, C. Rodrigo, E. Jimenez, et al.;*Tailoring magnetic anisotropy in epitaxial half metallic La(0.7)Sr(0.3)MnO(3) thin films*; Journal Of Applied Physics: **110,** 089903 (2011)

J. Lobo-Checa, A. Mugarza, J.E. Ortega, et al.: *Determination of the photoelectron reference plane in nanostructured surfaces;* New Journal Of Physics, B **13**, 103013 (2011).

M. Hassaine, M.A. Ramos: *Calorimetric studies at low temperatures of glass-forming 1-butanol and 2-butanol*; Physica Status Solidi A; **208,** 2245-2248 (2011).

B. Kabtoul, M.A. Ramos: *Structural and enthalpy relaxation processes in pure ethanol*: Physica Status Solidi A, **208**, 2249-2253 (2011)

C. Adrados, T.C. Liew, A. Amo, et al.: *Motion of Spin Polariton Bullets in Semiconductor Microcavities;* Physical Review *Letters,* **107,** 146402, (2011).

M.T. Gonzalez, E. Leary, R. Garcia, et al.: *Break-Junction Experiments on Acetyl-Protected Conjugated Dithiols under Different Environmental Conditions*; Journal Of Physical Chemistry C, **115**, 17973-17978 , (2011)

C.R. Arroyo, E. Leary, A. Castellanos-Gomez, et al.: *Influence of Binding Groups on Molecular Junction Formation;* Journal Of The American Chemical Society B **133,** 14313-14319, (2011).

A. Castellanos-Gomez, M. Wojtaszek, N. Tombreos, et al.: *Atomically Thin Mica Flakes and Their Application as Ultrathin Insulating Substrates for Graphene*; Small B.**7**, 2491-2497, (2011).

J.F. Sierra, V.V. Pryadun, S.R.Russek, et al.: *Interface and Temperature Dependent Magnetic Properties sin Permalloy Thin Films and Tunnel Junction Structures;* Journal of Nanoscience and Nanotechnology, **11**,7653-7664, (2011).

J.L.Endrino, C.Arhammar, A.Gutierez, et al.: *Spectral evidence of spinodal decomposition, phase transformation and molecular nitrogen formation in supersaturated TiAlN films upon annealing;* Acta Materialia,.**59**,6287-6296 (2011).

C. Riedel, A. Alegria, R. Arinero, et al.: *Contrast inversion in electrostatic force microscopy imaging of trapped charges; tip-sample distance and dielectric constant dependence;* Nanotechnology, **22,** 345702 (2011).

N. Mikusceit, S. Meckler, R. Wiesendanger, et al.: *Magne tostatics and the rotational sense of cycloidal spin spirals;* Physical Review B, **84,** 054404, (2011).

A. Politano, B. Borca, M.Minniti, et al.: *Helium reflectivity and Debye temperature of grapheme grown epitaxially on Ru (0001);* Physical Review B, **84**, 035450 (2011).

C. Riedel, A. Alegria, G.A. Schwartz, et al.: *Numerical Study of the lateral resolution in electrostatic force microscopy for dielectric samples;* Nanotechnology, **22**, 285705 (2011).

P.D. Kulkarni, S.S. Banerjee, C.V. Tomy, et al.: *Crossover from paramagnetic compressed flux regime to diamagnetic pinned vortex lattice in a single crystal of cubic Ca(3)Rh(4)Sn(13);* Physical Review B, **84**, 014501 (2011)

C. Riedel, A. Alegria, G.A. Schwartz, et al.: *On the use of electrostatic force microscopy as a quantitative subsurface characterization technique: A numerical* study; Applied Physics Letters **99**, 023101 (2011).

H. Martinez, Chacon E, P. Tarazona, et al.: *The intrinsic interfacial structure of ionic surfactant monolayers at water-oil and water-vapour interfaces;* Proceedings of the Royal Society A, **467**, 1939-1958 (2011).

A. Maldonado, I. Guillamon, H. Suderow, et al.: *Scanning tunnelling spectroscopy under large current flow through the sample:* Review of Scientific Instruments, **82,** 073710 (2011).

P. Perna, C. Rodrigo, E. Jimenez, et al.: *Tailoring Magnetic anisotropy in epitaxial half metallic La(0.7)Sr(0.3)MnO(3) thin films;* Journal of Applied Physics, **110,** 013919 (2011).

H. Bensalah, J. Crocco, V. Carcelen, et al.: *Study of ammonium fluoride passivation time on CdZnTe bulk crystal wafers;* Crystal Research and Technology, **46**, 659-663 (2011).

A. Politano, A.R. Mariano, V. Formoso, et al.: *Evidence for acoustic-like plasmons on epitaxial graphene on Pt(111)*; Physical Review B, **84**, 033401 (2011).

P. Nieto, D. Barredo, D. Farias, et al.: *In-Plane and Out-of Plane Diffraction of H(2) from Ru(001)*; Journal of Physical Chemistry A, **115**, 7283-7290 (2011).

F. Bresme, E. Chacon, H. Martinez, et al.: *Adhesive transitions in Newton Black films: A computer simulation study;* Journal of Chemical Physics, **134**, 214701 (2011).

M.F. Lopez , J.A. Jimenez, A. Gutierrez: *XPS characterization of surface modified titanium alloys for use as biomaterials*; Vacuum **85**, 1076-1079 (2011).

J.L. Pascual, Z. Barandiaran, L. Seijo: *Ab initio theoretical study of luminescence properties of Pr(3+)-doped Lu(2)O(3)*: Theoretical Chemistry Accounts **129**, 545-554 (2011).

A. Sorribes, B.G. Armendariz, D. López-Pigozzi, et al.: *The Origin of Behavioral Bursts in Decision-Making Circuitry*; PLoS Computational Biology **7**, 1002075 (2011).

V.A. Khodyrev, R. Andrzejewski , A. Rivera, et al.: *Shower approach in the simulation of ion scattering from solids*; Physical Review E, **83**, 056707 (2011).

J.M. Capitan, R. Otero, J. Alvarez, et al.: *Growth of Textured Adenine Thin Films to Exhibit only Chiral Faces*; Chemphyschem, **12**, 1267-1271 (2011).

J. Quereda J, M. Ramon, B. Silva, et al.: *Calibrating the frequency of tuning forks by means of Lissajous figures*; American Journal of Physics **79**, 517-5120 (2011).

R. Gonzalez-Moreno, C. Sanchez-Sanchez, M. Trelka, et al.: *Following the Metalation Process of Protoporphyrin IX with Metal Substrate Atoms at Room Temperature*; Journal of Physical Chemistry C, **115**, 6849-6854 (2011).

R.G. Marguta, Y. Martinez-Ratón, N.G. Almarza, et al.: *Theory and simulation of the confined Lebwohl-Lasher model*; Physical Review E, **83**, 04170 (2011).

J. Camarero, E. Jimenez, J. Vogel, et al.: *Exploring the limits of soft x-ray magnetic holography; imaging magnetization reversal of buried interfaces (invited)*; Journal of Applied Physics **109**, 07D357 (2011)

J. Camarero, P. Perna, et al.: *Role of anisotropy configuration in exchange-biased systems*; Journal of Applied Physics **109**, 07D730 (2011).

P. Perna, C. Rodrigo, E. Jimenez, et al.: *Magnetization reversal in half metallicLa(0.7)Sr(0.3)Mn O(3) films grown onto vicinal surfaces*; Journal of Applied Physics, **109**, 07B107 (2011).

G. Recio-Sanchez, G. Dominguez Cañizares, M. Manso, et al.: *Surface Functionalization of Nanostructured Porous Silicon by APTS: Toward the Fabrication of Electrical Biosensors of Bacterium Escherichia Coli*: Current Nanoscience, **7**, 178-182, (2011).

S. Albadelejo, M. Lester, J.J. Saenz : *Finite photonic crystal waveguide with an embedded cavity: optical conductance "dips" and vortices;* Journal of the Optical Society of America B, **28**, 756-759, (2011).

Y. Martinez-Raton, E. Velasco: *Effect of polydispersity and soft interactions on the nematic versus smectic phase stability in platelet suspensions*; Journal of Chemical Physics. **134**, 124904, (2011).

A. García-Etxarri, R. Gomez-Medina, L.S. Froufe-Perez, et al.: *Strong magnetic response of submicron Silicon particles in the infrared*; Optics Express **19**, 4815-4826, (2011).

H. Suderow, I. Guillamon, S. Vieira: *Compact very low temperature scanning tunneling microscope with mechanically driven horizontal linear positioning stage*; Review of Scientific Instruments, **82**, 033711 (2011).

L. Soriano, M. Sanchez-Aguado, R.J.O. Mossanek, et al.: *Interface effects in the electronic structure of TiO(2) deposited on MgO, Al(2)O(3) and SiO(2) substrates*; Surface Science, **605**, 539-544 (2011).

I. Guillamon, H. Suderow, S. Vieira, et al.: *Direct Observation of Stress Accumulation and Relaxation in Small Bundles of superconducting Vortices in Tungsten Thin Films*; Physical Review Letters, **106**, 077001 (2011).

A.B. Muñoz Garcia, L. Seijo: *Ce and Ia Single- and Double-Substitutional Defects in Yttrium Aluminum Garnet: First-Principles Study*; Journal Of Physical Chemistry A, **115**, 815-823 (2011).

A. Castellanos-Gomez, N. Agrait, G. Rubio-Bollinger G:*Force-gradient-induced mechanical dissipation of quartz tuning fork force sensors used in atomic force microscopy*; Ultramicroscopy, **111**, 186-190 (2011).

G. Gomez-Santos, T. Stauber: *Measurable Lattice Effects on the Charge and Magnetic Response in Graphene*; Physical Review Letters, **106**, 045504 (2011).

A.I. Krivchikov, M. Hassaine, I.V. Sharapove, et al.: *Low-temperature properties of glassy and crystalline States of n-butanol*; Journal of Non-Crystalline Solids, **357**, 524-529, (2011).

V. Uhlir, S. Pizzini, N. Rougemaille, et al.: *Direct observation of Oersted-Field-induced magnetization dynamics in magnetic nanostripes*; Physical Review B, **83**, 020406, (2011).

R.J.O. Mossanek, I. Preda, M. Abbate, et al.: *Investigation of surface and non-Local screening effects in the Ni 2p core level photoemission spectra of NiO*; Chemical Physics Letters, **501**, 437-441, (2011).

Y. Martinez-Raton, S. Varga, E. Velasco: *Biaxial nematic phases in fluids of hard board-like particles*; Physical Chemistry Chemical Phyics,**13**,13247-13254, (2011).

J.J. De Miguel, T. Bobek, C. Teichert: *Recents Patents on Self-Organised Magnetic Nanodot Arrays*; Recent Patents on Nanotechnology, **5**, 1-18, (2011).

Nieto P, Farias D, Miranda R, et al.: *Diffractive and reactive scattering of H(2) from Ru(0001): experimental and theoretical study*; Physical Chemistry Chemical Physics,**13**, 8583-8597, (2011).

M.A. Ramos, B. Kabtoul, M. Hassaine: *Calorimetric and thermodynamic study of glass-forming monohydroxy alcohols*; Philosophical Magazine, **91**, 1847-1856, (2011).

D. Farias y R. Miranda: *Diffraction of molecular hydrogen from metal surfaces*; Progress in Surface Science, **86**, 222 (2011).

E. M. Fernandez, E. Chacon, y P. Tarazona: *Thickness and fluctuations of free and adsorbed liquid films*; Physical Review B, **84**, 205435 (2011).

R. Otero, J. Maria Gallego, A. L. Vazquez de Parga et al.: *Molecular Self-Assembly at Solid Surfaces*; Advanced Materials **23**, 5148 (2011).

A. Perez-Escudero, G. G. de Polavieja: *Collective Animal Behavior from Bayesian Estimation and Probability Matching*; Plos Computational Biology, **7**, 1002282 (2011).

S. Sangiao, J.M. de Teresa, M.R. Ibarra et al.: *Andreev reflection under high magnetic fields in ferromagnet-superconductor nanocontacts*; Physical Review B, **84**, 233402 (2011).

P. Sutter, M. Minniti, P. Albrecht et al.: *A high-reflectivity, ambient-stable graphene mirror for neutral atomic and molecular beams*; Applied Physics Letters, **99**, 211907 (2011).

J. Lobo-Checa, J.E. Ortega, A. Mascaraque et al.: *Effect of photoelectron mean free path on the photoemission cross-section of Cu(111) and Ag(111) Shockley states*; Physical Review B, **84**, 245419 (2011).

A. Castellanos-Gómez, S. Bilan, L.A. Zotti et al.: *Carbon tips as electrodes for single-molecule junctions*; Applied Physics Letters, **99**, 123105 (2011).

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The INC thanks:

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Jose Augusto Galvis, for making videos and our Youtube channel.

Raquel Gomez and David Mínguez for Twitter.

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